Short Communications

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Age-specific Breeding in Emperor Geese

Joel A. Schmutz[1]

ABSTRACT.—I studied the frequency with which Emperor Geese (*Chen canagica*) of known age were observed breeding on the Yukon-Kuskokwim Delta, Alaska. No one- or two-year old geese were observed on nests. Three-year old geese bred at a lower rate than four-year old geese. These data suggest that patterns of age-specific breeding in Emperor Geese are similar to other sympatrically nesting, large bodied geese [Greater White-fronted Geese (*Anser albifrons*)] but delayed relative to smaller bodied geese [Cackling Canada Geese (*Branta canadensis minima*) and Pacific Black Brant (*B. bernicla nigricans*)]. *Received 23 Oct. 1999, accepted 5 Feb. 2000.*

Age-specific frequencies of breeding are of theoretical and applied interest. Age of first breeding reflects a trade-off between current and future reproduction (Viallefont et al. 1995) and thus is a key element in the evolution of demographic life histories (Stearns 1992). Ages of maturation and first breeding affect generation time, and place an upper bound on the rapidity with which populations can grow. All other demographic parameters being equal, a species with an earlier age of breeding will have a higher annual growth rate than a species that begins breeding at a later age (Stearns 1992).

Four species of geese breed sympatrically on the Yukon-Kuskokwim Delta (Y-K Delta), Alaska (Spencer et al. 1951). Black Brant (*Branta bernicla*) are the most thoroughly studied; occasional one-year olds breed, 72% of two-year olds, 73% of three-year olds, and at least 90% of four-year and older geese breed (J. Sedinger, unpubl. data). Although less rigorously quantified, Cackling Canada Geese (*B. canadensis minima*) exhibit similar patterns to brant (C. Ely, unpubl. data). Age of breeding of Greater White-fronted Geese (*Anser albifrons*) in northern Canada appears to be one year later than for brant (Warren et al. 1992); two-year old geese occasionally bred, but the mean age of breeding was greater than three years.

No previous researchers of Emperor Geese (*Chen canagica*) have examined age-specific breeding. Such information may prove valuable to understanding the evolved similarities and differences in life history between these four species of geese coexisting on the Y-K Delta. Differences in age-specific breeding between Emperor Geese and other Y-K Delta goose species could help explain why population growth rates observed for this species are lower than for other species (Petersen et al. 1994, Bowman et al. 1999). Here I document breeding by different age classes of Emperor Geese.

I conducted this study during 1993–1998 in a 90 km^2 area along the Manokinak River on the Yukon-Kuskokwim Delta, Alaska (61° 10′ N, 165° 10′ W). Each year, a crew of assistants and I rounded up flocks of flightless geese during their wing molt in late July and early August. Each captured goose was classified to sex and as either a gosling or an adult. We attached a standard Fish and Wildlife Service metal band and a plastic band with a unique alpha-numeric code to their tarsi. In late May and June of each year, we searched the same areas to locate nesting geese. When nesting geese were located, we used spotting scopes to scan their legs when they stood on the nest rim upon our approach. Geese originally banded as goslings and subsequently seen on nests constitute my sample for assessing age-specific breeding.

We banded 165 female goslings in 1993, 190 in 1994, and 125 in 1995. The younger age classes had progressively more opportunity to be observed nesting. In 1995 only two-year old geese were observable, in 1996 only two- or three-year old geese were observable,

[1] Alaska Biological Science Center, Biological Resources Division, U.S. Geological Survey, 1011 East Tudor Road, Anchorage, Alaska 99503; E-mail: joel_schmutz@usgs.gov

in 1997 only two-, three-, or four-year old geese were observable, and in 1998 five-year old and younger geese were observable. We never observed any one- or two-year old geese on nests. We observed a total of 3 three-year old, 7 four-year old, and 3 five-year old geese on nests. Four geese were observed on nests in multiple years; three as both four- and five-year olds and one as a three- and four-year old.

The principal conclusion from this study is that few (if any) two-year old geese breed and that three-year old geese breed at a lower frequency than older geese. The small sample sizes of this study necessitate a cautious interpretation. However, qualitatively, these patterns appear similar to those for Greater White-fronted Geese (Warren et al. 1992). In contrast, sympatric Black Brant and Cackling Canada Geese frequently breed at two years (72% of such brant) and numerous one-year old breeders have been documented (J. Sedinger, unpubl. data; C. Ely, unpubl. data). These interspecific differences are consistent with models describing positive relationships between body size and age at maturation (Stearns 1992). Adult female Greater White-fronted Geese (1809 g; Ely and Dzubin 1994) and Emperor Geese (1638 g; Petersen et al. 1994) are similar in mass when their eggs hatch and much larger than Black Brant (1025 g; Reed et al. 1998) and Cackling Canada Geese (1137 g; C. Ely, unpubl. data).

Life history theory predicts that interspecific differences in age-specific reproduction among potential competitors, as apparently occurs among geese on the Y-K Delta, should be accompanied by counter-balancing differences in survival and longevity (Stearns 1992). Interestingly, despite an earlier age of breeding, survival of Black Brant (Ward et al. 1997) was as high or higher than that observed for Greater White-fronted Geese (Schmutz and Ely 1999), Emperor Geese (Schmutz and Morse 2000), and Cackling Canada Geese (Raveling et al. 1992; Fowler and Ely, unpubl. data). These comparisons are complicated by differences in the time of study and effects of harvest; nonetheless, they suggest further examination of the comparative life histories of these sympatrically breeding species is warranted.

Since 1986 Greater White-fronted Geese and Cackling Canada Geese on the Y-K Delta have increased at average annual rates of about 11% and 14%, respectively (Bowman et al. 1999). I am unaware of population increases in geese more than 14% per annum, other than by immigration. Using models of Schmutz and coworkers (1997), the difference in population growth rates between these two species is approximately equivalent to a one year difference in age-specific breeding frequencies (i.e., model breeding frequencies of one-, two- and three-year old small-bodied geese as respectively equal to that for two-, three-, and four-year old large-bodied geese; Schmutz, unpubl. data). Although population growth in Emperor Geese is currently lower (Bowman et al. 1999, Eldridge and Dau 1999), the potential maximum sustained population increase of this species may be limited to that seen in Greater White-fronted Geese and not in Cackling Canada Geese, based on the species specific patterns in age-specific breeding.

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Winter Diets of Sandhill Cranes from Central and Coastal Texas

Bart M. Ballard[1,3] and Jonathan E. Thompson[1,2]

ABSTRACT.—We determined diet composition of Sandhill Cranes (*Grus canadensis; n* = 136) wintering in 4 regions of Texas during November–January 1996–1997 based exclusively on examination of esophageal and proventricular contents. Wintering Sandhill Cranes were predominately herbivorous, with animal matter representing less than 5% of their diet. Agricultural grains comprised most of the diet of wintering Sandhill Cranes from all regions of Texas except the South Texas Plains where nut-grass (*Cyperus* spp.) tubers made up a larger proportion of their diet. Cranes used agricultural and native plant matter and animal matter in different proportions among regions. There were no sex or subspecific related differences in frequency of occurrence or proportional dry mass of foods consumed by wintering Sandhill Cranes. Agricultural foods represented a larger proportion of the diets of Sandhill Cranes in this study than in previous studies conducted along the Gulf Coast, probably because of improved sampling methodology and differences in habitat conditions. *Received 8 Oct. 1999, accepted 16 Feb. 2000.*

Diets of migrating and wintering Sandhill Cranes (*Grus canadensis*) from the mid-continental United States consist predominately (88–100% aggregate volume) of agricultural grains throughout most of their range (Iverson et al. 1982, Tacha et al. 1985, Walker and Schemnitz 1987). However, previous researchers on diet composition of Sandhill Cranes wintering in southern Texas found that these birds principally fed (94–100% aggregate volume) on native plant and animal matter (Guthery 1975, Hunt and Slack 1989). Hunt and Slack (1989) investigated winter diets of Sandhill Cranes at Aransas National Wildlife Refuge using fecal samples, and found that wolfberry (*Lycium virginiana*) fruits, live oak (*Quercus virginiana*) acorns, and insects were the predominant foods by volume and frequency of occurrence. Guthery (1975) documented Sandhill Crane food

[1] Caesar Kleberg Wildlife Research Institute, Campus Box 218, Texas A&M Univ.-Kingsville, Kingsville, TX 78363.

[2] Present address: Ducks Unlimited, Canada, #200, 10720-178 Street, Edmonton, AB, T5S 1J3, Canada.

[3] Corresponding author; E-mail: bart.ballard@tamuk.edu